

sample

Chapter 10: Linear Regression test on Slope

LSR Line:

$$\begin{aligned} \hat{y} &= a + bx \\ a &= \bar{y} - b\bar{x} \\ b &= r \left(\frac{s_y}{s_x} \right) \end{aligned}$$

$$\begin{aligned} r &= \\ \bar{x} &= \\ \bar{y} &= \\ s_x &= \\ s_y &= \end{aligned}$$

Statistic	Parameters
\hat{y}	y
a	α
b	β
e_i	ε_i

Book/Formula Sheet:

$$\begin{aligned} \hat{y} &= b_0 + b_1 x \\ b_0 &= \bar{y} - b_1 \bar{x} \\ b_1 &= r \left(\frac{s_y}{s_x} \right) \end{aligned}$$

Book/Formula Sheet

$$\begin{aligned} b_0 & \quad \beta_0 \\ b_1 & \quad \beta_1 \end{aligned}$$

- The LSR line is a basis for ...

inference on a population
regression line

- The LSR line estimates:

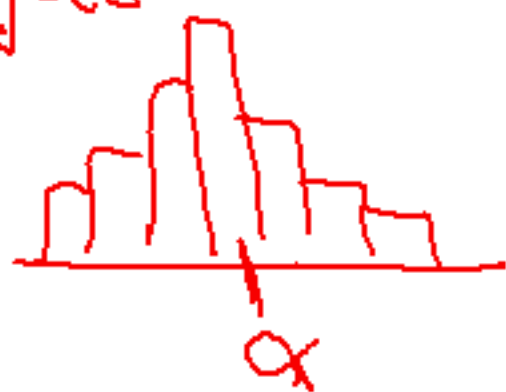
$$\hat{y} = a + bx + e_i$$

(x, y)

$$y = \alpha + \beta x + \varepsilon_i$$

a and b

- Unbiased... estimators of α and β
 - Normally... distributed
- centers: α



~~ϵ_i~~ = residuals = deviations = errors

- ϵ_i
- estimated by e_i
 - independent
 - normally distributed
 - center = 0 spread = σ

residuals = observed - predicted

$$\sum \epsilon_i = 0$$

$$\bar{X} \epsilon_i = 0$$

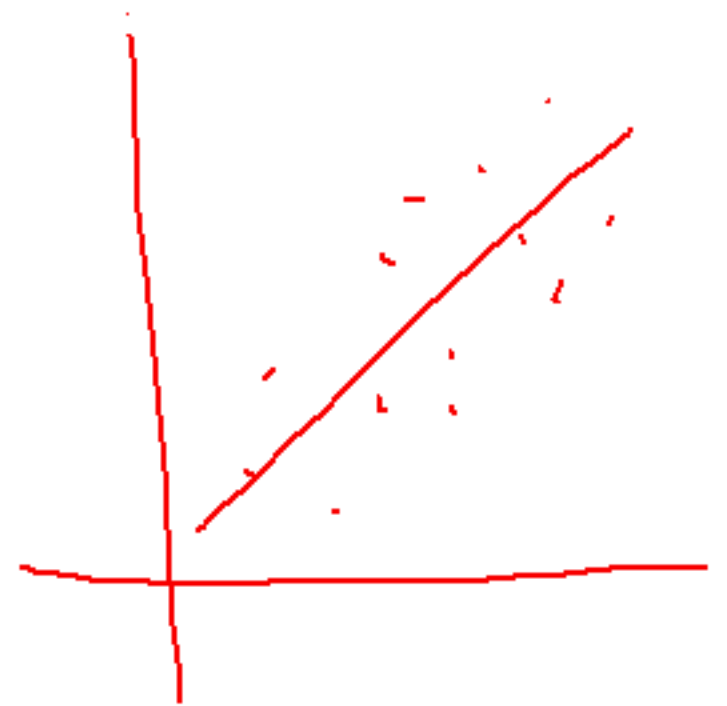
σ = Standard deviation of residuals

- estimated S

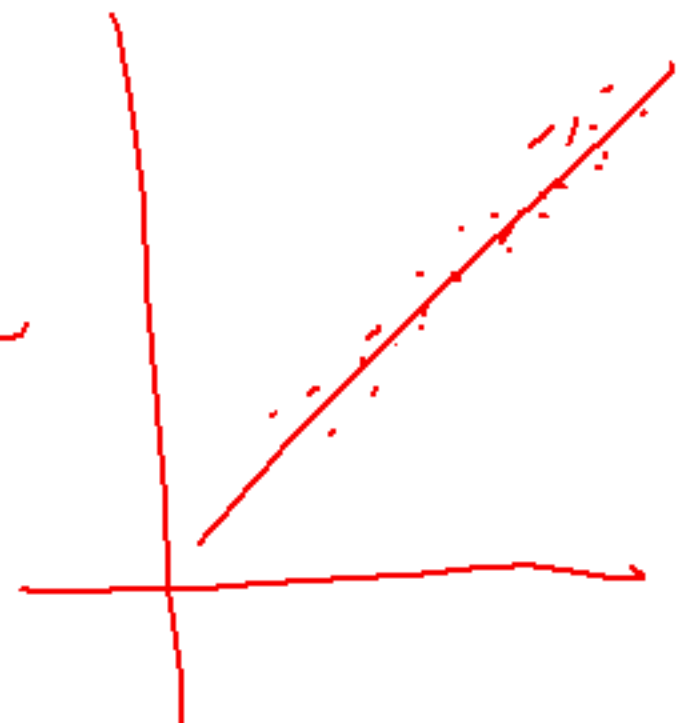
- $s = \sqrt{\frac{\sum e_i^2}{n-2}}$

- $df = n-2$

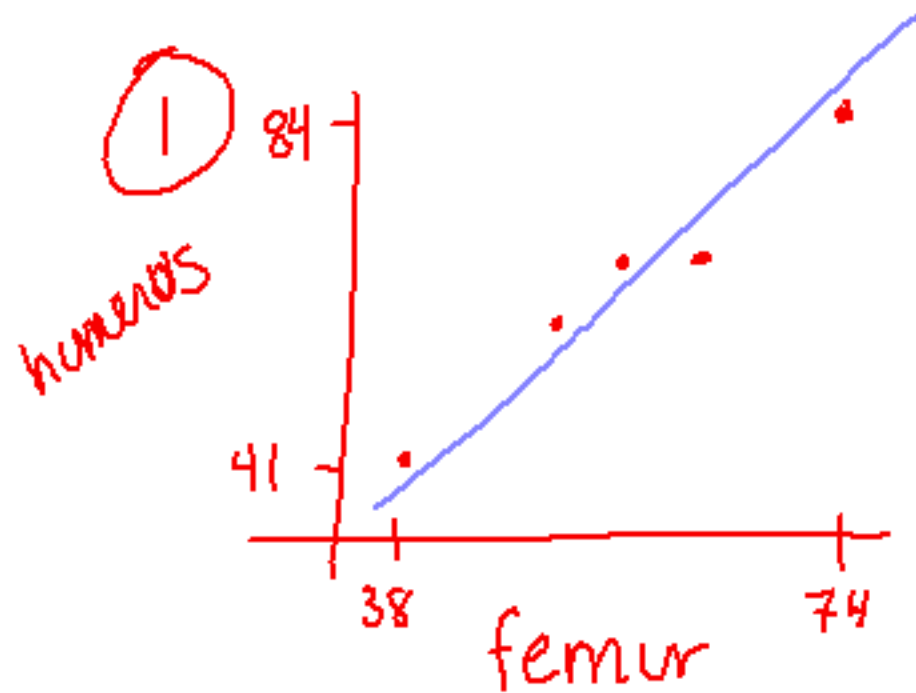
$$s = 10$$



$$s = 2$$



WORKSHEET 10.1



$$\hat{y} = -3.66 + 1.2x$$
$$r = 0.994$$
$$r^2 = 0.988$$

② β estimate = $b = 1.2$
 α estimate = $a = -3.66$

β = slope = change in cm of humerus
per cm of femur

③ $S = \sqrt{\frac{\sum e_i^2}{n-2}} = 1.982$

Sum (RESID²)

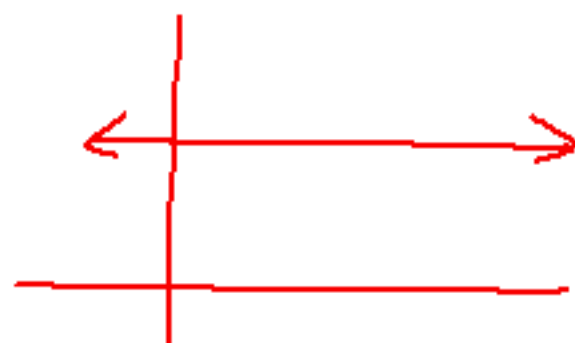
Test of Significance on β

- Testing... the slope of the pop. regression line (β) (+ or -)

Hypotheses

$$H_0: \beta = 0$$

$$H_a: \beta \neq 0$$



Test Statistic

$$t = \frac{b}{SE_b}$$

P-Value

$$P(t \geq \underline{\text{test stat}} \mid df=n-2)$$

$$t_{cdf}(LB, UB, df)$$

Conclusion

- same
- suff. evid that the slope of the pop. regr. line is $\neq 0$.
- thus as X increases, y _____.



Confidence Interval

$$b \pm t^* SE_b$$

Interpretation:

table

We are _____ % conf. that
the slope of the pop. regression line
btw. x and y is btw. _____ and _____ units/units.

Assumptions

- 2 indep. SRS
- true relationship
is linear ✓

HW: p. 695-696 #1

①	Constant	<u>Coeff</u>	<u>Std. dev</u>
		a	SE_a
X — LOS		b	SE _b

S = std. dev.
of resid.

r^2